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SOME PHYSICAL ASPECTS OF LIGHT AND ITS RELATION TO SIGHT*

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What is light? Professor Jeans, the English scientist, says that to find the explanation for light may be to find the whole story of the creation. Science is an attempt to set in order the facts of experience. Before we build a science we must ask of its facts and theories: Are they true? And it is with this in mind that I wish to present the different opinions, views and results of research by well-known students, scientists and physicists. The excerpts are from addresses, papers, books, and their opinions bearing on light and its relation to the eye. I take no credit to myself in this symposium.

The argument used in formulating laws governing optometry was, that we treat light before it enters the eye by the action of lenses whether such light be from the sun or artificial. Light is essential to vision, without light the eyes are useless. Let me remind you of the newly coined term of optiphosis. The definition given is "Any defect of vision, ailment of the eye or pathological disarrangement in the sight which has been caused by light." It will be necessary to recall to your minds a few of the fundamental facts in the physics of light, that is, to give briefly the theory of the nature of the waves, or rays, of which light is a part, the limits of these waves which emanate from the sun and other common sources and the character and intensity of the light which reaches the different parts of the eye.

Visible light is that portion of the radiant energy of the sun or other luminous body which is visible to the human eye. Or, to say it another way, visible light is a certain band of electronic waves which affect the retina of the eye. Let us look at these electronic waves a little more closely.

The sun, our principal source of light, emits waves, or better, radiations of many different lengths. These radiations are propagated through the ether of the universe and are called traverse waves. That is.

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the vibrations of the medium are at right angles to the line of propagation. All of these radiations move forward with the same velocity, 186,000 miles per second. They are measured by the distance from crest to crest. Because of the very small distances to be used, a special unit of measurement has been developed and is called the Angstrom unit. To understand this better it may be expressed in this way:

The Angstrom Unit (A. U.) equals, one-ten millionth of a m/m or one-two hundred and fifty-four millionth of an inch, or to express it in another way, one hundred millionth of a centimeter.

The shortest of these radiations or "electronic rays" are the so-called "cosmic rays" which are as short as .0004 A. U. (four-ten thousandth A. U.) There is a great controversy at the present time among the scientists regarding the cosmic rays, the seventh known type of electromagnetic radiation. Dr. Milliken says that the cosmic rays prove that the universe is self-perpetuating, by the combining in space of electrons and protons. Professor Compton reaches the conclusions that the rays are only electrons swerving to the poles because the earth is a great spinning magnet. Professor Jean holds that the rays are stars dying in a fierce radiance and bombarding us with cosmic rays in the process. Professor Regener sees primitive stars shedding cosmic rays and just as the bones of a dinosaur tells us something of the life a few million years ago, so these fossil cosmic rays reveal the Almighty in the act of fashioning electrons and protons into nebulae, suns, planetary systems and man himself. Professor Lemaitre argued before the last meeting for the Advancement of Science, that Creation began with radioactive atoms which threw off familiar Alpha Beta and Gamma rays so that the cosmic rays being electrons like the Beta rays become "glimpses of primeval 'fireworks'."

Now back to our subject. In this discussion, we are interested only in those radiations which may reach the eye. Because of the fact that the sun's radiant energy must pass through the envelope of air which encompasses the earth, a great number of the shorter wave lengths are absorbed before they reach the earth's surface. Of this radiant energy, or radiation emitted by the sun, a minute fraction, about one part in 2,200,000,000 falls upon the outer portion of the earth's atmosphere and a very small fraction passes through the atmosphere to the earth itself. The shortest solar waves which can pass through the atmosphere have a length of 3,000 A. U. so that we shall eliminate further consideration of any waves shorter than this.

The next series of waves are the ultra-violet, extending from 3,000 to 3,900 A. U. These visible radiations or light, begin at about 3,700 A. U. for violet light, and extend to 7,700 A. U. for red light. Newton, when he wrote his book upon light, did not know what was outside of the spectrum where the ultra and infra rays are now known to be.

Scientists could learn to talk and to work more accurately if they could find out the secret of light. The most familiar form of radiation, light, is now believed to be another manifestation of matter. It is held

to be electromagnetic in nature. Radiation has a certain duality of character which is also true of the electrons and protons inside the tiny atom. This discovery has led Jeans and other scientists to suggest that radiation and matter may be the same thing and that to find an explanation for light may be to find the whole story of the creation, as I have already said. Just as sound is the interpretation of sound waves, so light is the interpretation which the brain makes of certain types of waves too long or too short for the human ear to respond to; some animals with ears tuned to a different range of wave lengths, hear sound which makes no impression on us at all. So wonderful and mysterious are the fundamental principles of hearing and seeing that if it were possible to splice the optic nerve to the ear and the auditory nerve to the Retina we would hear light and see sound. The human eye can be compared to a radio receiver tuned to a limited range of wave lengths, while the range of electromagnetic waves is so tremendous as to be almost unbelievable. We see a very small fraction of the seven known types of electromagnetic radiations.

Dr. Luckiesh, director of the Lighting Research Laboratory at Nela Park, Cleveland, gives us a most remarkable word picture of the powers of the human eye in the following:

"Stars and electric lamps emit electro-magnetic energy differing only in wave lengths from that which radio receiving sets utilize. Our visual receiving sets see these sources. Objects reflect this energy and we see these objects. Colored media selectivity absorb energy of some of the wave lengths and we see color. All these are sending sets.

"Our eyes are receiving sets which embody the principles of a simple camera for focusing the images of objects upon the retina. The retina is the spread-out ends of the optic nerve which is a cable conveying impulses, perhaps electrical, to the brain. And the final marvel is that we see objects, not in our heads where the images are, but in space where the objects are. In other words, we see the objects out where we long ago learned that they are. This alone is great enough marvel to stimulate our consciousness of eyes and of seeing. It also provides a glimpse of the psychological realm into which studies of seeing lead us."

We commonly think of the sun as emitting heat and light, but what it actually sends out into space is radiant energy in the form of so-called electromagnetic waves, which are capable of producing the molecular motion called heat and the sensation called light. Radiation as it leaves the sun is extremely complex, consisting of rays of various wave lengths that have undergone numerous modifications in passing through the solar atmosphere. Radiations are divided into three parts; the central part consists of waves which stimulate the eye, the longer waves called heat waves of the infra-red part of the spectrum and the shorter rays or ultra-violet. These three groups of wave lengths all appear to have identical properties, but remember only the central group stimulates the eye. These three groups, however, do not cover the entire limit of the spectrum.

Part of the radiation coming from the sun is "scattered" by air molecules and dust particles, and some of this eventually reaches the earth. Another part of the radiation is absorbed by ozone in the upper atmosphere and by water vapor in the lower. A larger proportion than

either of these is reflected back into space by clouds.

Of the radiation that gets through to the earth, some is reflected. The rest is absorbed by land and water, converted into heat and then emitted as long wave radiation. This type of radiation is readily absorbed by the water vapor in the atmosphere, which in turn radiates the energy it receives partly back to the earth and partly to the sky. It is mainly the presence of water vapor that prevents the air over any land from becoming intensely cold at night when the sun is below the horizon. The solar radiation that falls upon the snow-covered ground or upon the upper surface of the clouds about 70 per cent is reflected. Of that falling upon snow-free ground or upon water, the portion reflected is very much less. It averages perhaps 7 per cent, but varies with the nature of the surface.

Let us consider some of the mysteries of the composition of sunshine, that is, the spectral quality of solar radiation. Let us remember that the three senses of sight are light, form and color. There is no color without light, no light without color, yet color is not all light. In the last analysis its conception and appreciation, perception and appreciation are subjective and they vary for every individual. The scientific aspect of color recognizes two sharply marked divisions: the color of light and the color of pigments. One is known as the Additive system which is based on light. The other, the Substractive system is based on pigments. The light system when mixing its primaries produces white and the pigment system when mixing its primaries produces black. The color of light is more fundamentally important. Practical complexities arise in the second division, for colored rays of light do not play nearly so important a part in our life as the light reflected by pigments in plants and animals, by paints and varnishes, etc.

The analysis of the color of light may be direct and comparatively simple. White light, such as we receive from the sun and from all heated bodies, is no other than that small part of the energy radiated by such bodies to which our eyes are sensitive. When this white light is passed through a prism, it is spread out into a multicolored band, called a spectrum, showing that white is in reality not so much a color as a combination of colors.

In fact, the Physicist by the aid of the spectroscope finds that: As the frequency (vibrations) increases per second, visible light is composed of some 180 hues, but so blended together that the seven colors predominate.

Recently, the Bureau of Standards released this bulletin:

"Dr. Judd of the Bureau of Standards in collaboration with Professor Tyndall of the University of Iowa after concluding elaborate series of experiments find that Professor Tyndall, who was the subject in the experiments, could distinguish about *200* pure colors when each of these colors is mixed with varying degrees of white light. Dr. Judd estimated the number of discernible *shades* and *hues* would be approximately one million."

When a body emitting light is comparatively cool, the red rays will be relatively stronger and the object appears red hot. When the tem-

peratures rise, the red rays diminish, while the blue rays increase in strength, and the object will ultimately appear white hot: but in all cases the light covers the full spectrum, contains the whole gamut of colors, from the deepest red to the utmost violet.

While the light vibrates, it also moves forward, always with the speed of 186,000 miles per second, and produces waves. In the case of red light, whose vibrations are slow, the light advances a great deal during one complete vibration: the wave length is long; for blue and violet light it is comparatively short. Instead of using the idea of color, which is somewhat vague, the scientist thus replaces it by that of wave length, which he can express numerically: Light of just one wave length when passed through a prism does not produce a whole spectrum, but one single line. It is called monochromatic and it constitutes, so to speak, the only pure, unadulterated color. This then is the way colored light originates, and the way science looks at it and analysis it with the aid of a spectroscope. The eye, however, is but a poor differentiator and can be easily deceived. Moreover, nearly all the objects we observe shine by reflected light—sunlight by day and artificial light by night. Why, then, one may ask, is the sky blue, the grass green, and a geranium red? It is the same sunlight on all of them. With the sky it is a matter of scattering of sunlight by the innumerable fine dust particles in the atmosphere, which scatter blue light more than red, and thus provide a blue background for every thing we see.

A blade of grass and a geranium flower both act as a mirror to sunlight: both are unfaithful mirrors, but unfaithful in different ways. The pigment in the grass and in all other foliage is very partial to red light and retains practically all of that which falls on it: so the reflected light is deficient in red, and therefore appears green to us by comparison with white light that contains all colors. With the geranium it is just the other way: its pigment absorbs most of the green light.

The question of how the idea of color is brought to our consciousness, how the color apparatus in the eye functions, and how the impressions are transmitted to the brain is still unsolved. Hering, Helmholtz, Edridge-Green, and Ladd-Franklin are only some of the names associated with color theories. The rods and cones, those infinitesimal details of the retina, have not yet yielded up their secret. Most probably the actual process is a chemical one, the rods functioning chiefly in recording the intensity of light, while the cones are able to differentiate, and to register the proportion between a certain number of "primary" colors.

Since the above was written, Sir Arthur Eddington, the English scientist has this to say,

"No well informed person ought now to believe that a leaf is green. The leaf sends out waves. They splash on the retina with a result that we see green. But what is sent out from the leaf to produce the sensation of green no one knows."

It appears advantageous to treat color as having three dimensions, as in other material objects we observe, and these in the case of color we call hue, value and chroma. The hue is the quality that distinguishes one

color from another, as red from orange: the value expresses the lightness or darkness of the color, the chroma measures the intensity of the color, whether it is pure or mixed with gray.

Other characteristics that may be recognized in colors are warmth and coldness, reds being warm and blue colors cold. Men, it appears, have a slight preference for cold colors, women for warm colors. Nature's idea for a pleasing effect appears to be that of mixing large quantities of cold colors with a few splotches of warm, bright colors.

Probably the most interesting problem of the physiology of vision is the transformation of the light image upon the retina into the nerve current, which passes back to the reflex center and visual areas of the brain. Physiological chemistry had been trying to solve this problem. The act of seeing is complex and depends upon more than one simple factor. Recent studies show that a great number of factors are involved in the act of seeing, namely, (1) Size, (2) Contrast, (3) Brightness, (4) Time, (5) Psychological process, (6) Physiological changes.

Vision has been divided into three parts, known as the physiochemical, the physiologic and the psychologic phases. Light strikes the eye and enters and has an influence upon the structures which it meets. From being just light it is transformed into nervous energy. Here the first phase ends and the second begins. The impulses travel along the nerve and into the brain and here they reach the third phase and what we call "seeing" takes place.

In the second phase *if* the optic nerve, or its continuation, is defective, there cannot be sight, and it is not necessary that I tell you that *if* the brain is defective all the light that may enter will not be interpreted.

How we see and recognize colors is complex. We all have patients who are totally color blind and others who are unable to distinguish between certain colors. Investigations have been conducted as to the relationship of the eye and general physical conditions to the recognition of colors. The research being done will prove of great value in diagnosing infections and poisons and the effect on the color fields, giving us valuable information about our patient's health.

As stated before color is not a substance, but is simply the effect produced by light falling on an object, part of which will be reflected and part absorbed. If the object has no hue the reflected light will create a white sensation on the retina and the object will be called white, while if the reflected light creates a hue, such as red, yellow, green or any other hue on the retina, the name of the colored object will be correctly registered on the retina. Should the object absorb all the light and reflect none the image on the retina will be that of a black object. If there is no light there is no color.

The sense organs and the imagination are in many ways imperfect, or at least they deceive us by the impressions they convey. Illusions which give us double vision and inverted images are stern realities, but

fortunately are corrected in the very young by the sense of touch, and as life advances by the power of convergence; moreover, we see clearly only such things as attract our attention.

Many theories have been advanced regarding color vision. Of the five sense organs, the eye is the most important. The eye sees no color in a ray of white light, but when broken up by passing through a prism it is transformed into the band of color known as the Spectrum, thus the sun supplies every hue that the eye is capable of interpreting.

The value of color psychology is more and more recognized as a factor in decorating our homes and surroundings. In a lecture by Dudley Crafts Watson, an authority in color psychology, he said,

"The colors employed in the decorating of a room have a definite effect upon the nervous system."

The color combinations of your wearing apparel send out a combination of vibrations that may tend to soothe or irritate.

The expression "Seeing is believing" is by no means true. For instance, imagine two objects of the same size, one red, an advancing color, the other blue, a receding color, stationed in the line of vision. The message conveyed to the brain says the size of the two objects is not the same—the red one appearing larger than the blue because of its greater luminosity. Hues in the red end of the spectrum are warm, bright, and compelling and known as the advancing hues, that is, they give the visual effect of advancing towards us, thus the illusion of their appearing larger and nearer; while those of the blue end give the impression of coolness and reticence, and their visual effect is that of greater distance and smaller images. Advancing hues in order of their forcefulness are red, orange, and deep yellow and their derivatives; while the receding ones in order of their timidity are blue, violet, or green (providing blue predominates); black and white are not known as hues, white being an admixture of all hues; and black is the absence of all hue. However, white has an advancing and black a retiring quality.

Orcella Rexford, color Psychologist, says that combinations of color, color whose vibrations do not synchronize, unconsciously affect the health and character and the governing moods of the masses. In this respect consider the individual colors evoking emotional impulses, a sense of appreciation or a feeling of discomfort.

I am indebted to Dr. Ernest H. Kiepenapp of Fairbault, Minn., for his fine interpretation of "Psychology of Color."

"Individual colors have a somewhat different significance than do colors in combinations:

"Red indicates Ambition and Power. It sympolizes fire and danger; it is stimulation and is said to develop a fiery temper.

"Pink, a higher aspect of red, being combined with white attracts Beauty, Art and Music. Those who love pink are said to possess intellectual ideals, are temperate in all things and self-controlled.

"Orange represents a love for truth. It symbolizes Glory, Fame, Harvest and Warmth; it is the climax of Luminosity.

"Yellow, love for harmony, art, sculpture and music. It symbolizes sunlight;

and represents harvest and joy. Some Yellows, however, are sedative to the nerves.

"Green represents a love of mental ideas in the realm of philosophy. It is the color of the fruitful earth, fertility, prosperity.

"Blue represents a love of facts or science. It is associated with the eternal blue of the sky.

"Violet represents a love of justice and righteousness.

"Lavender is a tint of violet, is symbolic of divine love, truth and wisdom, and suggests sweetness and sentiment.

"Purple suggests aristocratic, proud, ambition and authority.

"Black is the symbol of the night, and represents gloom, pessimism, destruction and Death.

"Brown indicates a passive state of the mind.

"Gray neutrality and quiet dignity.

"White symbolizes the day, sanctity, clarity and purity. It has always been associated with spiritual understanding, regeneration, and illumination."

The sun which is devoid of color in itself, is able to give us every hue that the eye can appreciate. Color perception has been found sharper in women than men. Dr. Godlove of the Museum of Science and Industry in New York, reporting results of tests for color blindness on more than six thousand five hundred persons, says that more men than women have abnormal color vision and that among color blind men were many interior decorators.

Under the existing conditions of our modern life, our profession is confronted by eye strain in its relation to glare whether by unnatural or natural reflected concentrated light. Thus we must consider both visual comfort and visual acuity. There is the veiling glare, dazzle glare, and blinding glare. Dr. Luckiesh describes the veiling glare as light more or less uniformally super-imposed on the retinal image, thus reducing contrasts and, hence, visibility. The veiling effect is commonly seen on glossy paper reflecting light with such dazzling effect that the type seems to fade and become less visible, producing the same effect as halation in taking pictures when the sun shines in a camera.

Dazzle glare is described as any light within the field of view of such excessive brightness as to interfere with vision and become distracting, discomforting, or even painful. Reflecting, or veiling glare, may be dazzling.

Blinding glare is described as an over-exposure of excessive brightness on the retina, to which the eye cannot adapt itself. The eyes are temporarily blinded when one passes from a dark room into a brilliantly lighted one or in bright sunshine, and in this connection I wish to call your attention to the new tunnel lighting system first introduced in Paris. Instead of turning on all the lights in the tunnel on dark days, as might ordinarily be expected, the reverse has been found to work out better. On sunny days all the lights are on. If the day is gray, every other bulb is glowing, and on dark days one light in four is used. At night every eighth lamp is turned on. The lights are set into the walls behind sheets of glass designed to avoid glare.

The following explanation was given.

A tunnel brightly lighted at all hours of the day and night confuses the vision of the driver on entering or leaving; the purpose of the system is to keep the intensity of illumination about the same inside as on the streets, so that no sudden adjustment or focusing of sight is required.

Canal street in New Orleans is some 120 feet wide. The center of the street was originally an open canal, but is now covered over by a cement walk which has been colored to reduce glare.

Reflected light is not the only cause of eye strain, but it is a contributing factor that must be taken into consideration in prescribing for many of our cases, as brought out by Dr. Fish in his article (Vol. 9, No. 5, American Journal of Optometry), "Optometric Interpretation of Fundus Anomalies and When To and When Not To Prescribe Tinted Lenses."

Dr. Wood, Professor of Diseases of the Eye, University of Maryland, in a lecture said in part:

"It becomes necessary in any study of Eye Strain, to disabuse oneself of faulty notions; to recognize what eye strain is not. It is not the mere existence of refractive error; it is not defective sight, unless effort is made to overcome this defect without artificial aid, and not always then. It may exist and yet the eyes themselves possess normal shape. Possibly this idea of eye strain may be understood if for the moment we drop the eye strain part of the term and center our attention on "Strain." Webster defines the verb "Strain" thus: 'to draw with force, to extend with great effort.' What is force or effort to one person is ordinary exercise to another.

"Applied to the eye, the force or effort needed to secure vision in spite of the handicap of a badly shaped eye may be readily overcome by the nerve and muscle structure of the eye itself. We may define eye strain, then, as the attainment of vision good enough for the ordinaries of life by keeping the eyes under a tax too great for one or more of the following:

"(1) The nerves or blood vessels connected with the eyes and their appendages, ie: the lids, conjunctiva, lacrimal apparatus, etc.;

"(2) Remote organs as the head, stomach, neck, and back through causes which we understand only in part.

"(3) The welfare of the eyes themselves."

He says, "It remains to go over briefly some of the outside influences to arrange the symptoms of eye strain and to draw conclusions as facts justify.

"Even the *glare* of *too much light* not infrequently causes functional eye strain. The symptoms of eye strain have been called—conscious and unconscious. By the former I mean," he says, "Those of which the patient becomes aware. As intimated, they may be untirely local: fading of vision, eye pains, inflamed lids, watering, etc. They may be reflex in the form of distance pains or disturbance of certain organs. They may be psychic.

"The unconscious symptoms of eye strain are mainly the bad effects on eye structure—Insistence should be made on the possibility of eye strain causing the remote disturbances of which mention has been made."

Therefore, in his opinion, glare is the cause of eye strain.

Dr. Nowakowski, in lecturing at the School of Hygiene and Public Heal, Johns Hopkins University, says in part:

"*Glare* is a condition of visual discomfort which is dependent upon two factors, both due to contrasts of illumination on the retina. One is attributable to the failure of the eye to adapt itself to a stimulus of small area and high intensity, in consequence of which there is an irritation of the hypersensitive retina. The other factor is a depres-

sion of visual acuity when there is a sufficient contrast between the illumination of the glare spot and that of the fovea."

Dr. Luckiesh, author of "Light and Health," says,

"The sun's fiery mass emits much ultra violet, but when the solar radiation reaches the surface of the earth, the shortest wave length measured is found to be about 2,900 A. U. This abrupt ending of the spectrum of solar radiation at the earth's surface is apparently due to the absorption due to ozone in the upper atmosphere. The solar radiation becomes visible as violet, when diffracted at wave length 3,900 A. U. The octave of radiation between 3,900 A. U. and 2,900 A. U. is called ultra violet."

Quoting further, he says,

"If the near Ultra Violet (3,000 A. U. to 3,900 A. U.) and the near infra red are harmful to the eyes, it is difficult to see *why* eye trouble is not very prevalent among those who work out doors a great deal of the time, certainly no evidence of this is available."

Dr. Luckiesh clearly says that the crystaline lens of the eye absorbs radiations shorter than wave lengths 3,500 U. V. and that the interior of a healthy eye has its own natural protective medium against any chemically active radiation.

Dr. Luckiesh in a public address said:

"Light is essential to vision. Without light the eyes are useless. But light is only the raw material. Proper and adequate lighting is the finished product. Quantity of light has a great deal to do with the visibility of an object. The distribution of brightness in the field of view has much to do with the ability to see with comfort. Light sources should be shaded and they should be surrounded with diffusing media, or the light should be diffused in some effective manner, if the lighting is to be satisfactory.

"It is an interesting fact that there is more eye strain encountered under glaring lighting conditions when the eyes are called upon for *near work* such as that of reading, than when they are merely in casual use. For example, in the shade of a building with the eyes unshaded a large expanse of sky may be only slightly glaring. However, as soon as the eyes are concentrated upon the page of reading matter and are engaged in the effort of reading, one becomes conscious of discomfort which in time may become unbearable unless the eyes are shaded. A similar effect may be detected indoors; that is, glaring conditions become much more annoying when the eyes are called upon for their best efforts.

"Remarkable as has been the advance in light production in the past twenty years, we see comfortable out doors under intensities of illumination a thousand times greater than the average which we have at night in our homes. Have we ever seriously asked ourselves why 70 per cent of the eyes of the adults have one or more defects? Other parts of the body mature very satisfactorily. It has been convincingly proved that eyes develop less effectively under better lighting conditions.

"Along with inadequate lighting, we find improper use of light generally prevalent, thus contributing to waste through eye injury, discomfort, cheerlessness, inefficiency, and otherwise. Light sources are commonly unshaded, or the light is often insufficiently diffused. 23 per cent of the electric filament lamps in the homes have no shades. 50 per cent of the shades do not adequately shade or diffuse the light. The filaments of lamps must be bright to be efficient. Therefore, to reap the full advantage from modern light sources, they should be shaded."

F. C. Caldwell, author of "Glare and Its Effects on Human Vision, has this to say:

"The importance of glare has been recognized by regulations against it in the industrial and school lighting codes, drawn up by the illuminating Engineering Society and followed more or less closely in the laws of several states. Impairment of vision comes from both the reduction of the pupillary area and from the direct effect of the light entering the eye. It is often more serious than is ordinarily realized. The discomfort, which protects the eye by compelling it to turn away from the sun or other

excessively bright lights, is an important natural safety measure. It is, however, the light of lesser flux or brightness, not generally recognized as a source of glare, that is more likely to cause fatigue and injury to the eyes."

"As such reflections generally come from below, their effect is magnified by the greater sensitiveness of the eye to light from this direction. Common cause of this are reflections from bright materials upon which work is done, glass or polished table tops and glossy paper. In the latter case, an effect is produced which is known as veiling glare. The bright light reflected from the surface of the paper to the eye largely masks that coming from the type and greatly increases the eye strain involved in reading."

Dr. Sheard of the Mayo Clinic says:

"The function of the ultra-violet in producing ocular discomfort has been over-emphasized, for the reason that no light source as yet devised has in percentage as much ultra-violet as does full sunshine. Much of the irritation and excessive fatigue which shop and office men and women experience is due to glare."

Dr. Verhoeff and Louis Bell, Ph.D., in an article, "The Pathological Effects of Radiant Energy on the Eye," says:

"Pure air, generally speaking, extremely transparent, produces some small but sharp absorption in the visible spectrum and completely wipes out the extreme ultra-violet."

Until quite recently physicists attributed the glare in light to certain invisible rays at the extreme ends of the spectrum. Occupational glass was produced for the purpose of excluding the radiant energy of the ultra-violet rays. Physicists now remind us that the eyes have always been exposed to the full force of sunlight. This fact, and tests, have proved that there is not enough ultra-violet in ordinary light to harm the human eye.

"Science" has this to say:

"The chief usefulness of protective glasses lies not so much in their absorption of any specific radiation as in their reducing the total amount of light to the point where it ceases to be psychologically disagreeable or to be inconveniently dazzling. Glasses which cut off both ends of the spectrum and transmit chiefly only rays of relatively high luminosity, give the maximum with the minimum reception of energy."

Dr. Woll has this to say regarding the subject of glare:

"The retina has two vision elements—The rods and the cones. The rods are sensitive to dim light; the cones to bright light. These two sensitivenesses are called twilight vision and daylight vision respectively. Twilight is more acute when peripheral to the central focus and when bright light finds its way to the peripheral field (Rods), an over-stimulation results. The photographer calls it halation; the individual calls the experience a glare. Glare and dazzle are caused also in central vision when the object viewed has for a background a high reflecting surface, especially if the background has a yellowish or bright white color. Such a condition causes as much pain and fatigue as does the competition that is developed when the rods are overstimulated by an antagonistic light during the use of the cones for central or direct vision. The condition cannot be relieved by colored lenses if they increase the yellow color of the light and change the color values."

The Bureau of Standards, Coblentz and Stair, says:

"From inquiries received it appears that Opthalmologists are sometimes confronted with antagonistic claims regarding the effect of ultra-violet solar radiation on the eye. They may be advised to use either (1) glasses which are opaque to the ultra-violet or (2) lenses which transmit the ultra-violet in order to keep the retina in a healthy condition. In view of the facts that the human eye is accustomed to ordinary intensities of unfiltered sunlight there seems to be no need of considering the question of injury by the ultra-violet present in daylight. On the other hand, there is no evidence that the eye will suffer injury by the absence of these ultra-violet rays; that is to say,

there seems to be no evidence that the presence of the ultra-violet rays is essential in order to keep the normal eye in a healthy condition.

"In the case of an 'albino' eye, that is, in lacking in pigmentation—beneficial results have been obtained by using glasses that absorb the ultra-violet.

"The Softlite glasses are slightly tinted to the visible rays. However, in the ultra-violet they differ but little in transmission from the white crown glasses commonly worn in spectacles.

"With the greatly increased present day activity outdoors, conditions arise where the eye should be shielded from the glare of the intense sunlight reflected from sidwalks, highways, snow, sand, etc. Under such conditions light shade, tinted lenses should be worn to reduce the intensity (the glare) of the light on the eye. The use of such glasses, as just shown, will reduce also the intensity of the ultra-violet rays which has already been selectively absorbed by reflection from terrestrial objects. For it is a common property of most substances (for example, growing vegetation, brown sand, clay, granolithic material) that the reflecting power for ultra-violet is lower than for visible radiation. Hence a spectacle glass that is sufficiently tinted to reduce the glare of the sunlight will also reduce the ultra-violet, and, hence, prevent injury from these rays.

"As already mentioned, the human eye is accustomed to ordinary intensities of unfiltered sunlight, and there is no evidence that injury will result from the presence of the ultra-violet solar rays viewed under normal working conditions. Neither is there evidence to support the claim sometimes made that the presence of ultra-violet radiation is necessary in order to keep the eye in a healthy condition, and, hence, that it is necessary to wear glasses that transmit these rays."

Therefore, the purpose of a tinted glass is to tone down light more than a white lens, subduing the glare that blurs images, and filtering light to the degree of clearest visibility. This transformation of light is exemplified by the ray filters that are used in photography to insure a clear image.

Brilliancy naturally determines the degree of eye strain due to glare. Therefore, what is needed is not a lens to filter out any particular rays of the spectrum, but one to reduce brilliancy without reducing visibility or altering color impressions.

In concluding this paper, permit me to say, I have endeavored to analyze the ray of light and its many ramifications and phenomena from the time that it comes boiling o'er night's rim bringing to life by its magic wand, the sleeping world and when concluding the day, leaving behind it a sea of fire and beauty. It governs the course of human life on earth. Flaming with energy it gives us heat and health—for light is life. When we look at the stars at night and consider the mysteries of the cosmic rays, rays that have taken countless ages of light years to reach us, who among us doubt that the great Architect of the universe has not planned with infinite care for our welfare.

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THE GENERAL MANAGEMENT OF DIFFICULT REFRACTIVE CASES ASSOCIATED WITH ABNORMAL MENTAL STATES

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The Function of the Subconscious Mind

That the mind has a profound effect upon the body is becoming more and more an accepted fact. In order that we should have a clear understanding about the affect of the mental states upon physical functions, we must have some knowledge about the "Subconscious Mind."

One of the most important functions of the subconscious mind is that of taking control of the involuntary activities and functions of the human body through the sympathetic nervous system, the cells and cell groups. Hudson claims that "the subconscious mind has absolute control of the functions, conditions and sensations of the body." While some authorities still disagree as to what the subconscious mind is, they all agree on this point that it may be taken to be as that part or field of the mind which has absolute charge and control of the greater part of the physical functioning of the body.

Henry Wood says of the Subconscious Mind: "It acts automatically upon the physical organism. It cognizes external facts, conditions, limitations, and even contagions, quite independent of its active counterpart. One may, therefore, 'take' a disease and be unaware of any exposure. The subconsciousness has been unwittingly trained to fear, and accept it, and it is this quality, rather than the mere inert matter of the body, that succumbs. Matter is never the actor, but is always acted upon. This silent, mental partner in operation, seems to be a living, thinking personality conducting affairs on its own account. It is a compound of almost unimaginable variety, including wisdom and foolishness, logic and nonsense, and yet having a working unitary economy. It is a hidden force to be dealt with and educated, for it is often found insubordinate and unruly. It refuses co-operation with its lesser but more active and wiser counterpart. It is very 'set' in its views, and only changes its qualities and opinions by slow degrees. But, like a pair of horses, not until these two mental factors can be trained together can there be harmony and efficiency."

Atkinson[1] claims that "In order to understand the important part played in the physical economy by the Subconscious Mind, it is only necessary to understand the various processes of the human system which are out of the ordinary field of the voluntary or conscious mind. We then realize that the entire process of nutrition, including digestion, assimi-

lation, etc., the processes of elimination, the processes of circulation, the processes of growth, in fact, the entire processes manifested in the work of the cells, cell-groups ganglia, physical organs, etc., are in charge of and controlled by the Subconscious Mind. Our food is digested and transformed into the nourishing substances of the blood, then carried through the arteries to all parts of the body, where it is absorbed by the cells and used to replace the worn-out material, the latter then being carried back through the veins to the lungs where the waste matter is burned up, and the balance again sent on its journey through the arteries re-charged with the life-giving oxygen. All of these processes, and many others of almost equal importance, are out of the field of the conscious or voluntary mind, and are governed by the Subconscious Mind. As is well known in considering the Sympathetic Nervous System, the greater part of the body is dominated by the Subconscious Mind, and that the welfare of the major physical functions, depends entirely, or almost so, upon this great area or field of the mind."

Dr. G. R. Patton said that, "Faith, confidence, belief and hope are the working forces that make for cure. The mind as a dynamic force exerted over the functions of the body has been doubtless operatively manifest from the beginning of our existence." The phrase, "The mind as a dynamic force," referred to the various forms of suggestion as well as to the various effective faculties of the mind, or those states caused by the sympathetic action of the brain, such as faith, confidence, belief, imagination, emotions, hope and the like. Any one or all of them may become active over the bodily functions.

Suggestion.

What is suggestion? Different interpretations have been placed upon suggestion, which have been more or less confusing. Professor Chas. Baudouin[2] of France probably gives the clearest definition. Suggestion he states is an idea proposed or imposed by the operator, is accepted by the mind of the subject. This idea undergoes transformation into an action so that the object of the idea is realized.

Psychologists contend that man has a dual mind: (1) the conscious, (2) the subconscious. Hudson[3] designates this duality as (1) objective, and (2) subjective. The objective mind is the one of ordinary waking consciousness which takes cognizance of the objective world through the five special objective senses, while the subjective mind is that intelligence which manifests itself in all subjective states, and conditions, that is when the objective senses are asleep or are wholly or partially inhibited. The subjective mind, according to Hudson, is constantly amenable to control by the power of suggestion, and a suggestion, he claims, is a statement made by one intelligent being to another presumably intelligent being, otherwise it could produce no result, physical or mental. "A therapeutic suggestion," claims Hudson, "in order to be effective must be a statement addressed to an intelligence whose faith can be stimulated, and who possesses the power to carry the suggestion into effect. Such an intelligence is found in the subjective (subconscious) mind of man."

The Laws of Suggestion.

In a clear and concise discussion of suggestion, Baudouin gives some definite laws of suggestion, which are as follows:

1. Law of Concentrated Attention—the idea which tends to realize itself in a spontaneous manner is always an idea upon which spontaneous attention is concentrated.

2. Law of Auxiliary Emotion. When for one reason or another, an idea is enveloped in a powerful emotion, there is more likelihood it will be suggestively realized.

3. Law of Reversed Effort. When an idea imposes itself on the mind to such an extent as to give rise to a suggestion all the conscious efforts which the subject makes in order to counteract this suggestion are not merely without the desired effect, but they actually run counter to the subject's conscious wishes and tend to intensify the suggestion.

4. Law of Subconscious Teleology. When the end has been suggested, the subconscious finds means for its realization.

Mental Analysis.

Before any attempt is made to introduce any suggestion to the patient, the examiner should first make a mental analysis of his patient which should cover the following points:

1. Is the patient in too much of a hurry about things?
2. Does he lack self-control?
3. Is he selfish?
4. Are his thoughts centered too much upon himself?
5. Is he lacking courage?
6. Does he lack self-confidence?
7. Is he habitually exaggerating?
8. Is he under the rule of fear-thought?
9. Is he worrying over trifles?

Once this mental analysis or diagnosis is made, the examiner should try to determine the form of assistance that will most quickly go to the root of the trouble. In some of these cases which may show upon examination a refractive condition or a muscular imbalance, it will be found that while the patient will not respond to lenses or to oculo-prism treatment, he may most often respond to either one or both of these forms of therapy if they are accompanied by the proper suggestion.

We wish to emphasize at this point that whenever we speak of the application suggestion, we do not refer to have the patient repeat a group of well worn auto-suggestions or stock phrases such as "day by day I am getting better and better," or "my headache is getting less and less, it is leaving me, have no more headache," and etc. It is very questionable just what these stock phrases can accomplish, however, applying the proper ocular therapy in connection with the proper type of suggestion will, if properly carried out, bring about the desired results.

Kinds of Suggestions.

There are two different types of suggestions: 1. Constructive. 2. Destructive. Constructive suggestions are those which are positive, optimistic and include thoughts of courage, confidence, determination, hope, patience, peace.

These suggestions tune up the entire system and it will more rapidly respond to any form of therapy whether it be medical, surgical or optometric. They will promote good effects of any other physical treatment which may be carried out such as oculo-prism treatments, electro-therapy, massage or any other corrective exercises.

Destructive suggestions are negative, pessimistic, thoughts which depress both mind and body, and they obstruct the free flow of nervous energy, they retard the success of any form of therapy which may be applied, they are a hindrance in the path of progress. Mental analysis clearly demonstrates that the phenomena and doings of every day life, the things uttered in most casual conversation will reveal quite unknown to the patient what is going on in his subconscious mind. These phenomena, these acts and utterances are a clue to all that is most vigorously censored to all that is hidden in the mind, which is least subject to conscious supervision.

Confidence and Its Effect.

In order to obtain successful results in any type of a case, it is of utmost importance for us to secure and hold the confidence of the patient. This is especially true with the type of cases in which there is some mental involvement. Many investigators agree that when there is perfect confidence, the type of therapy applied is of comparatively little importance. The methods and techniques applied may vary within very wide limits without in any way effecting the results, provided that the patient has the confidence in that particular type of therapy applied in his case. This more than anything else accounts for the many successes attributed to the different types of healers in the preceding pages.

Many physicians have repeatedly stated that in certain cases an injection of H_2O will bring the same relief from pain as will the drug hypodermic, and that in some cases, they would not prescribe medicine of any kind if it were not for the fact that the medicine brings into play the psychic factor of hope, because of the patient's faith in it. Dr. T. A. Barton, in an address before the Indiana State Medical Society said, "We all know how difficult it is to get good results from medication in which our patients have no confidence, and it is an established fact that we get better results from drugs which are given with the patient's knowledge of their intended effect. ***I have often produced desired results from means entirely inert, stating the desired and expected effect of its administration. I have frequently quieted the severest pain by injecting pure water into the arm of the patient.***"

Indeed Dr. William Osler, a British Medical Authority, made the statement that drugs are mostly prescribed where the patient's attitude, or the attitude of his family makes it expedient in order to create in

him the buoyant expectancy, which is the real curative agent. Dr. Richard C. Cabot of the Harvard Medical School holds similar views. The results obtained by medical practitioners from the application of suggestion upon their patients are similar to those obtained by optometrists and others by employing the agents at their command. We have repeatedly seen remarkable results to follow the prescribing of a weak spherical or cylindrical lenses, results which are entirely out of proportion with the insignificant refractive error corrected. The question has often been raised, is it really possible for a correction of a + .25 D. S. or a + 0.12 D. Cyl. to bring such remarkable relief as it does in certain cases. The answer is that it is not the power of the weak spherical or cylindrical lens that bring the relief but *rather these lenses are used as agents to bring into play certain psychic factors because of the patient's faith in them.* The following case will illustrate the point:

Mrs. G. M., age 32, was brought to us for an examination in February, 1923. She complained of severe frontal, tempral and occipital headaches. A thorough searching examination disclosed very little error of refraction in the distance or near, neither was there any muscular imbalance. Two subsequent examinations during the same week revealed nothing more than the first examination. We first suggested to Mrs. M. to have a physical examination made by her physician, this she refused stating that she had been under his care as well as under the care of others for over two years without getting any results and she concluded with these remarks: "I came to you because you helped Mrs. P. and from the interest you have shown in my case and from the thorough examination you have given me, I feel confident that you are going to help me, too." Now after we have made up our mind to tell the patient that the refractive error was negligible and that she does not need glasses, we were forced by her statement as well as by our observation of *her mental state* to change our decision and prescribe for her a + 0.25 D. S. (This being the maximum that could be crowded on.) Why? We had to do in this case as Dr. William Osler said, "We had to prescribe where the patient's attitude makes it expedient." We not only had to take her attitude into consideration, but we also could not overlook the fact that there was brought into play her psychic factors of *faith, confidence,* and *hope* which if properly directed will turn failure into success in many of our puzzling cases. In handing her the prescription we made this statement to her in a very *positive manner*, we told her that in some cases a very small error refraction like hers may cause very much trouble, it will therefore be necessary to wear her glasses constantly and report for a re-examination within a month. Two weeks later her husband, Mr. M., called at the office to inform us that his wife was getting along fine and that her headaches completely disappeared within 48 hours after she began wearing her glasses. This is only one of the many cases of this type that the writer has prescribed for and there are many other optometrists who have had similar experiences.

In handling cases of the type just described, we are not only dealing with refractive abnormalities but with mental states as well. The ques-

tion may be asked are we not practicing medicine when we make use of mental analysis and apply suggestion. The answer can only be to the negative. Professor Baudouin of France says that "suggestive practice therefore, must not be looked upon as a chapter of medicine, any more than suggestion must be regarded as a case of will. With the work of the New Nancy School, it passes from the Medical to the pedagogical sphere. It does not so much consist of a descriptive science as of an education or re-education of certain mental attitudes and habits which human beings have been tending more and more to lose."

"Modern times have been characterized by the conquest of the material world. It is therefore natural that, when we turn back to man, we should retain the habits of thought we have contracted in our prolonged intercourse with the physical universe. Such is the invariable method of conventional medicine. Thereby, however, it reaches no more than a part of the human being. It moves from without inwards, though there is just as much need that it should radiate from the center to the periphery. It has a wide knowledge of the effect of physical agents upon man, but we still have to learn the reaction of the human mind upon physical agents. The work of modern science is a great achievement, but it is incomplete. For its completion a certain change is necessary both in outlook and method."

As the philosopher Spir has well put it, "We are masters of nature externally alone, inwardly we are nature's slaves." Studying only too well all that surrounds us, we have forgotten our own personality, and now or never is the moment when we must put into practice the Socratic maxim, "Know thyself." The doctrine of the New Nancy School in conjunction with other doctrines of contemporary psychology, enables us to make a great advance in this knowedge."

Nearly all modern optometrists are applying suggestion to a certain extent intentionally or unintentionally; the degree of success obtained depends greatly upon the examiner's knowledge of applied psychology. We must bear in mind that disturbed mental states will often times give rise to symptoms simulating those of organic diseases, especially so in cases of hysteria. Many times it is found that from the symptoms complained of by patients of abnormal psychic condition a wrong diagnosis is made by the physician and the wrong remedy prescribed. Speaking about suggestion, Dr. Pierre Jannet[4], one of the foremost living psycho-pathologists, pointed out in a course of lectures delivered at the Harvard Medical School that it is impossible to estimate the number of unnecessary and useless operations performed to remedy conditions which really called for treatment by suggestion. Suggestion is an important factor in all forms of human activity. The optometrists and the physicians make use of it in the examination room, the preacher on the pulpit, the salesman in the store, the attorney in court, and the intelligent mother at home to properly train her children, the teacher in school and so on down the line; we can show that suggestion has been and is being applied in every walk of life and is a factor of great importance in every field of human activity. No matter in what

field suggestion is applied the results are in direct proportion to our knowledge of the laws of applied psychology.

The optometrist making use of suggestion must bear this in mind that it is effective mostly in cases of functional abnormality and not in pathological condition. It is therefore important that when pathology is suspected and confirmed that the optometrist should send his patient to a specialist where the pathology will be properly treated.

Effects of Suggestion.

A well known authority on suggestion said: "Certain results will follow certain thoughts, and in every instance that it is possible to get the patient to think the thoughts we desire, we secure the results we desire. It is the work of the suggestionist to place these thoughts in the mind of the patient so that he is bound to think them, and this can be done to some degree, if not perfectly, in every case. It is well to have faith, but faith is not absolutely necessary at the outset. It is time enough for the patient to have faith in the treatment when he can perceive the benefit he is receiving. Understanding the mental and physical changes which follow a certain thought, the suggestionist is able to bring about those mental or physical changes, by using direct suggestion in such a way that his patient is bound to think the thoughts which will produce the results. A man may not have faith in the statement that the thought of lemon juice will stimulate the flow of saliva, but if he will imagine for a moment that he is squeezing the juice of a lemon into his mouth, the saliva will immediately flow more freely than usual, regardless of his faith. Similarly, many, if not all of the organs of the body, can be affected by impulses following certain lines of thought and these impulses will follow the thought and stimulate the organs regardless of faith. It is simply necessary to get a patient to think the proper thoughts, and it is in the thought directing that the work of the suggestionist lies."

Energizing Mental Organism

In certain types of cases, we find that what is needed most is to stimulate certain organs to normal function which have been functioning abnormally before. This can be accomplished in some instances through the application of various physical agents or by energizing the organism through mental stimuli. In some of these cases, we find that the mental organism will respond best to a combination of physical and mental stimuli. Mental stimuli claims Hudson are necessarily more direct and more positive in their effect. The therapeutic value of physical as well as mental agencies is in proportion to their respective powers to produce the effort of stimulating the subjective mind to normal function. And directing its energies into appropriate channels.

Mental disturbances a cause of muscular and nervous abnormalities.

The effect of emotional disturbances upon the muscular and nervous function is becoming more recognized as our knowledge of this subject increases. For instance, we know that the nerve centers maintain a condition of muscle tone. That is the muscular capacity for work depends upon their state of tonicity. In a case where a person is run down the muscles

are in a flabby state and consequently can not carry on the usual amount of work with comfort. The muscle tone is strengthened by the nutritional impulses which are constantly being sent out by the nerve centers. If the nerves or nerve centers controlling any group of muscles do not function properly, those muscles lose their tone, become flabby and waste away. This is due to a lack of nutritional impulses. And as disturbed emotions cause lowered action of the nerves and never centers, this will cause a corresponding lowering of the vitality of the organs they control.

In many cases it can be directly traced that emotional disturbances caused by worry, anxiety, fear, etc., are the cause of disordered nerve centers, which in turn bring about a state of lowered local nutrition which may lead to many complications, ocular muscular deficiencies being one of them. The effects of disturbed emotional states upon health can further be illustrated by studying some of the cases on record.

Professor Ball of Paris has recorded a case of a young man who was in perfect health, had a quarrel with a relative and worked himself up into a terrible state of anger. When he returned home and wanted to tell his wife what had happened, he found that he had become stone deaf and he was unable to speak. This condition cleared up after a while.

The famous surgeon, John Hunter, used to say that his life was in the hand of anyone who roused his temper, this was borne out by his sudden death in the Board Room of St. George's Hospital. He was then seized with a fatal attack after getting up in a fit of rage to make a speech denouncing one of his colleagues. While these cases may illustrate the effects which great anger may produce, lesser degrees may produce conditions less serious. Investigators generally agree that disturbed mental states are to a large extent the cause of many physical and functional abnormalities, also that physical abnormalities will cause in some cases disturbed mental states. The physician, psychologist, and optometrist are in a position to observe this dual effect of mind on body and the effect of the body upon the mind. Professor Lighter Witmer, director of the Psychological clinic of the University of Pennsylvania reports the following case which is of special interest to optometrists. "A public school teacher brought to the psychological laboratory of the University of Pennsylvania, a boy fourteen years of age, for advice concerning the best methods of teaching him, in view of his chronic bad spelling. Her assumption was that psychology should be able to discover the cause of his deficiency and advise the means of removing it. Up to that time I could not find that the science of psychology had ever addressed itself to the ascertainment of the causes and treatment of a deficiency in spelling, yet this is a simple development defect of memory, and memory is a mental process concerning which the science of psychology is supposed to furnish authoritative information. It appeared to me that if psychology was worth anything to me or to others, it should be able to assist the efforts of the teacher in a retarded case of this kind. The absence of any principles to guide me made it necessary to apply myself directly to the study of the mental and physical condition of this child, working out my methods as I went along. I discovered that the important factor in producing bad spelling in his case was an eye defect. After this defect

had been corrected, his teacher and I worked together to instruct him as one would a mere beginner in the art of spelling and reading."

Many optometrists today can relate similar experiences. We have often met cases in our practice where we are in a position to trace out the mental disturbances being the result of refractive errors and muscular abnormalities, or where the ocular discomfort may be due to an abnormal mental state. It is much easier to trace the former than the latter. However, to be successful in our work and to be of greater help to our patients, we should be prepared to analyze the mental as well as the physical ocular abnormality.

The refractive cases having abnormal mental state of different types cannot very easily be classified. The following cases will illustrate some of the types most prevalent.

Mrs. M. E., age 53, called for a refraction and complained of headaches, intra-ocular pains, inability to use eyes with comfort for distance or near. Upon examination it was found that she had no refractive error for the distance and only needed a low spherical correction for the near, the ordinary presbyopic correction for her age, which was prescribed by the previous examiner. There was no muscular imbalance of any kind present. We were about to tell the patient that her eyes were in good condition and that she did not need anything as far as glasses or oculo-prism treatments are concerned. However, before doing this we decided to have her call for another examination. The second examination did not reveal any more ocular abnormalities than the first with this exception that we found out that Mrs. M. E. was examined by a leading ophthalmologist about two years ago and he told her that her eyes were normal and only gave her a pair of reading glasses. She knew that he was wrong, and that she not only needed glasses for constant wear but that she also needed a colored protective lens. She then went to another refractionist and to her great surprise she was told the same thing. Here we had a patient free from any physical abnormality hence needing no lens to correct it. However, upon close investigation we found existing a certain *psychic condition* which could not be relieved unless lenses of the kind Mrs. M. E. felt she must have to give her comfort were prescribed. We prescribed a pair of Softlite plano lenses in a kryptok adding the presbyopic bifocals. These glasses gave her immediate and complete relief. A few months later while being away from home an accident occurred and she broke her lenses and immediately all of her former troubles returned. She called my office by long distance telephone telling me about the accident and informed me that she was returning to the city and wanted me to make certain that a new pair of lenses be made up and ready for her upon her arrival.

Mrs. E. L., 32, school teacher called for a refraction; complained of headaches, dizzyness and inability to use her eyes with comfort especially at near. Her glasses neutralized O. U. $+ 0.50 \bigcirc + 0.75$ D. C. axis 90. These were prescribed about six months ago but she was very emphatic that she was certain that these glasses were not right, because the doctor did not give her a thorough examination. And not only does she not

get any relief by wearing them but they make her condition definitely worse. Upon examination we found a refractive error which called for a correction of a + 0.50 D. S. ⊃ + 0.75 D. C. axis 90 or exactly what she was wearing. There was no muscular abnormality present. We decided to tell the patient that the prescription she is wearing is correct and that there is no need to change her lenses but during the course of our conversation we learned that she had already been told that very thing by two other refractionists and it did not help matters in any way, there was no need for us to do the same thing. We therefore told the patient that we are going to prescribe a new and different pair of lenses for her and we were confident that they will give her comfort. A new pair of glasses were prescribed of exactly the same power as her other lenses the only change we made was in the shape of the lenses so that she would be positive that they were different. After wearing these new and *different* lenses she reported that she is perfectly comfortable now. Four months later she broke her glasses and we told her to wear her former glasses until the new lenses are made up. When she called at the office the next day she informed us that all of the former symptoms returned as soon as she began to wear her former glasses. There is hardly a refractionist to be found who at one time or another did not meet similar conditions in his practice.

Another interesting case is that of Mr. L., age 52, Clerk of District Court, he was sent to me by his Physician for an eye examination on May 28, 1927. Upon taking his history, we learned that he had a nervous break down and that for the last four years he had been treated by a number of leading specialists and that he had spent some time in hospitals and sanitariums, but he failed to get any improvement. Upon examination, we found a moderate amount of hyperopia which was previously corrected by another refractionist. He also had 4 P. D. of esophoria, low adduction and no abduction. His fusion reserve both positive and negative were low. I was reluctant to prescribe oculo-prism treatments although the patient having heard about these treatments wanted to get started at once. Having tried so many other types of therapies without getting any results he was ready to try something different, however, we advised against it for the time being, and advised instead for him to go away for a vacation for three months to the northern part of Minnesota and to come back for a re-examination upon his return. He followed our advice and left for his vacation the next day. He had no difficulty in getting away in view of the fact that he had a deputy do his work in court for the last four years. as he was unable to do any of it himself during all that time.

After being away on his vacation for ten weeks he called again for a re-examination. He claimed to feel some improvement, upon examination it was found that his esophoria practically disappeared and his adduction was O. D. 16/12; O. S. 16/12; abduction was O. D. 3/1; O. S. 3/1.*

He was anxious that we start oculo-prism treatments although the three months were not up. This we did, and in about 15 treatments his adduction and abduction were practically normal, his fusion reserves were

*The numerator designates the break and the denominator the recovery point.

also improved. The patient was very much elated over the fact that he noticed a gradual improvement of his condition. I, too, was pleased with the results. It may be of interest to learn that after the first treatment he went directly from my office to a heart specialist and had his heart examined, then he went to the nerve specialist for an examination, as he wanted to know whether or not these treatments were effecting his physical or his nervous system. Fortunately these examinations did not reveal any bad after effects. He told me about this a few days later. Of course, this still further strengthened his confidence that these treatments will be of great help to him.

After treating him for another month, there was no further change in his ductions and fusion power but the patient kept on feeling a steady and gradual improvement and kept on expressing his belief that he will get entirely well if he will keep on taking the treatments long enough, as this is the only therapy in the last four years that really helped him on the road to recovery. I was then confronted with a dilemma. As far as I was concerned I had nothing else to offer in his case, as I accomplished all that I set out to accomplish and was ready to discharge the case, but as far as the patient was concerned he just began to recover. I discussed this case several times with my associate, Dr. Koch, and we both felt that from an ethical standpoint the patient should be discharged at this point, as I could offer him nothing further, but from a practical standpoint the patient was in a psychic state where he felt that he at last has found a place where he is going to be helped back to health and if treatments were discontinued at that time, he would probably make no further headway. I then decided to keep him coming until he is completely well again or until we reach a stage where he does not notice any further improvement. We gradually cut down on the number of treatments from 6 to 3 a week, later on the treatments were still further reduced until we finally had him coming only once a week. This was kept up until May, 1928, when he felt that he was able to do all of his work in court the same as he had 5 years ago, before he had the nervous breakdown. I might mention this point which may be of interest that when I started to work on him he had no confidence at all in his own ability, he collapsed each time he merely took the pen in his hand to sign his name. All during the treatment period I made him do some work in his office for very short periods at the beginning and increased these periods gradually as his condition improved. And when I was finally ready to discharge this patient, I instructed him to send his deputy away for two months' vacation and that he himself shall do all the work in his office without any assistance. He was afraid at first to make such a daring move, however, my assurance that he is perfectly able to attend to all the duties of his office was the finishing touch to help him regain complete confidence in himself. On the next day, he sent away his deputy on a long vacation and himself assumed all of his duties in court chamber. He reported at the end of one month that he was not only able to do all of his work but that he is feeling stronger right along. This patient reports for a re-examination every three months and we find that he is in perfect condition, and is one of our most satisfied patients.

Now if we go back to our classification of physical therapy agents we find that a combination of the last two agents named, that is lenses and prisms and psychotherapy or applied psychology were responsible for our successful results in this case. In cases of this type we have to prescribe more for the mental state than for the physical abnormality.

Dr. Uddgren[5] of Sweden speaking before the Medical Women's International Association at Bologne, Italy, at the 1928 Congress presented some interesting data concerning the effects of mental attitudes and general body illness on the refractive conditions of the eyes. Dr. Uddgren reported cases of children where the visual acuity was 20/100 or less which were restored to normal by purely psychological treatment. There is a case on record of a girl who developed severe ocular disturbances, refractive anomalies and lowered visual acuity, every time she had to take an oral or written examination. The mental tension incident to the examination caused these changes. The effects of mental states upon the individual is of great importance to the modern optometrists. If worries, fears, obsessions and the numerous complexes within the mind of our patients can modify the refractive conditions of their eyes, and if disturbances of refraction and vision can be produced by disturbed psychic states, and if certain mental states will cause a train of symptoms similar to those caused by ocular abnormalities, then our only remedy in these cases is the use of applied psychology, suggestion or psychotherapy. It is now an accepted fact that functional and pathological abnormalities may be produced or aggravated by certain emotions. The wholesome effect of cheer, hope, optimism, courage and other exhilarating emotions are marvelous in their therapeutic power. If the optometrist himself possesses these characteristics fortunate indeed are his patients. If he can instill these psychic emotions into his patient he is indeed a philosopher and certainly a practical psychologist. The most difficult and puzzling cases can be successfully treated through the proper application of proven psychological principles.

In studying our difficult cases we must not merely pay attention to the amount of hyperopia, myopia or astigmatism present, or merely take an inventory of the duction and reserve fusion powers in a mechanical way the same as the garage man goes over an automobile where he pays attention merely to parts and their working order. We are not trying to bring out that we pay too much attention to refractive error or muscular abnormalities but what we want to point out is that we are dealing with thinking, feeling, reasoning human beings and we must always take into consideration the workings of their minds and in many instances we can assist by making their mind work along channels which will be of material help in bringing about the desired therapeutic results.

How can we accomplish this? *It is an established fact that it is the natural desire of the human mind to make an idea a fact.* This statement is the underlying foundation for the practical application of psychotherapy or applied psychology. All we have to do is to study our case and put the right ideas into the minds of our patients by properly directed suggestion, along with our proper application of any form of treatment or exercise

we may think best in the particular case. The optometrist has a great advantage in this particular field over any other practitioner, whether he be medical, chiropractic or osteopathic because we are dealing with the eye which is the *gateway to the mind.* We are in a position not merely to suggest the idea, but we also can see the idea made a fact and we can make our patient realize that the idea has been transformed into a fact and secure from the patient still greater concentration and co-operation, the greatest attributes which are essential in securing the best results. For instance, we are giving fusion training to a patient and we place the Wells F-L card in the stereoscope, the patient is told to try and get the letter F and L to superimpose and make a letter E out of the two letters. At first he can not accomplish this, but as he works along he notices the letters coming closer together and finally you will hear the remarks "I have it." "It is an E now." The patient acted upon your suggestion; he tried to make a fact of the idea you suggested; he is conscious of the fact that the letters were apart from the beginning and as he worked along, they gradually became closer together and finally they superimposed and formed a letter E. The patient is in a position to see for himself that he now can accomplish something he could not do before, he can see for himself the results, and the optometrist should try during the treatment to *first instill the idea into the patient's mind and then direct the mind by means of suggestion to make the idea a fact and during all that time he should try to focus the patient's mind upon the accomplishment.* This is just one example, there are many other ways of accomplishing the same results. Each case is a law in itself. And the better knowledge we have of applied psychology, the better our results will be. We should always remember the laws of suggestion as given in the first part of this chapter and should constantly try to increase our knowledge of psychology. We have a wonderful opportunity to apply it. All of us use it a little but there are few who use it to the extent that they get the best results for their patients.

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A REVIEW OF FOUR PAPERS[1] PREPARED BY THE DEPARTMENT OF RESEARCH IN PHYSIOLOGICAL OPTICS OF THE DARTMOUTH MEDICAL SCHOOL AND PUBLISHED IN THE ANNALS OF THE DISTINGUISHED SERVICE FOUNDATION OF OPTOMETRY*

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These four papers are co-related, but will be reviewed individually. They deal with the horopter; the size and shape of the ocular image; metamorphopsia due to the application of ophthalmic lenses, and last the correction of metamorphopsia. Helmholtz defines the horopter as the *"locus of corresponding retinal points."* To put it differently, though not accurately, we may say that the horopter is (in the schematic eye) the curved plane where lie the intersections of all corresponding retinal points of the two eyes for any given point of fixation. These points theoretically produce one single mental image.

I.
THE HOROPTER AND CORRESPONDING RETINAL POINTS.

A. Ames, Jr., and Kenneth N. Ogle.

This first paper contains a simplified description of the horopter and a new definition as *"that surface in space determined by the spatial counter-points of specific subjective direction values of the brain."* The writers include in their explanation the resultant mental stimulation.

The subjective direction value of the brain is dependent on the *"dioptric properties of the optical system of the two eyes and the nature of distribution of the elements of the two retinas."* If the projection lines of the retinal elements coincide with the fixation lines we have normal vision, in the meaning that we do not have metamorphopsia. If the projection lines meet sooner than the fixation lines we have a larger image and vice-versa. This metamorphopsia may be present in all meridians, in only one meridian or may be opposite in two principal meridians, thus giving various shaped mental images which beyond a certain point

*Submitted for publication October 26, 1932.

[1]The authors of these four papers, the titles of which are given in the above manuscript, are: Dr. A. Ames, Jr., Dr. Kenneth N. Ogle, Dr. Gordon Gliddon, Dr. Leo F. Madigan and Dr. Elmer H. Carlton. Their original work from which the above was abstracted is from the Annals of the Distinguished Service Foundation of Optometry, 718 Broadway, West Summerville, Boston, Mass. 66 pages, Illustrated, 1932.

interfere with binocular single vision. In any of these cases the horopter does not lie on the Vieth-Muller circle but on a new curved plane which varies as the fixation point changes.

Two relations must be found to determine objectively the size and shape of retinal images. The first is the horopter, the second is the monocular relation between the optical projections of retinal elements and their associated directional subjective values. This relation is found by means of threads being adjusted to apparent equal separations. Their true separation is then measured thus giving the relationship sought. *Fixation disparity or retinal slip* is a physiological phenomenon the authors found in phorias, either true or induced. They describe it as a disparity between fixation and convergence, i.e., the eyes are either more or either less converged than the distance requires according to the type of phoria.

This paper is introductory of those following.

II.

THE IMPORTANCE OF THE RELATIVE SIZE AND SHAPE OF OCULAR IMAGES IN VISION. A. Ames, Jr., Gordon H. Gliddon, and Kenneth N. Ogle.

While readers are familiar with the gross dissimilarities in size and shape of images due to aphakia and high anisometropia, this paper concerns small differences ranging from 0.75% to 4%. A method has been devised to measure such small differences accurately using a haploscope; this instrument reveals differences of size as well as shape of the images and is similar to a mirror stereoscope and was on exhibition at the time this paper was presented.

The targets used in these tests consist of similar fixation points, and dis-similar reference points outside Panum's (fusional) area. The targets are so arranged that if the ocular image in the right eye is larger than that of the left, the dots of the right eye will be beyond the dashes of the left. If this displacement is true in all meridians we have a symmetrical enlargement, if only in one meridian we have enlargement in that meridian alone, thus altering the shape of the ocular image.

The amount of these changes is measured by using lenses which have no dioptric power but have the property to increase the apparent size of the image. They vary in steps of 0.25%. An apparatus for clinical use to measure the differences of size and shape of images has been constructed, however it has not as yet been used in actual practice. As perception of depth is in part dependent upon the appearance of the ocular image, it follows that marked alterations will produce a false perception of distance. The apparent position of objects in space will also be changed. The relative difference in size and shape was tested in 200 cases and in all cases the difference was found to be less than 4%. It was determined that binocular vision is difficult if not impossible with differences greater than 3%.

The conclusion of these as well as other experiments was that differences of from 0.50% to 1.00% were equivalent or comparable to abnormal refractive conditions of about 0.62 diopters plus or minus. It

was also found that nature has some capacity of adjustment for these differences, a fact inaccurately known to refractionists by re-interpretation of the retinal image.

The measure of discomfort from these small differences is not constant. Cases are cited showing that small differences produced severe discomfort in individuals while large differences were tolerated by others.

The conclusions of this paper are that while small differences in size and shape might not be unsupportable *per se*, they are the exciting cause to abnormal functioning of ocular faculties and thus give rise symptoms often attributed to something else.

III.

LENSES FOR CHANGING THE SIZE AND SHAPE OF DIOPTRIC IMAGES. A. Ames, Jr., Gordon H. Gliddon and Kenneth N. Ogle.

While ordinary lenses can be used to change the size and shape of ocular images, they also produce a change of refraction in the patient's eyes offsetting the benefits derived from correction of differences. But by using zero power lenses on various base curves such as 3, 6, 9 and 12, small differences in size can be corrected. The method will be thoroughly understood if the reader mentally compares flat to corrected lenses and the principle involved.

The magnification of these lenses was computed and compared for changes in size with the instrument described above. Not satisfied with the results other lenses were devised ultimately resulting in a lens system having the same approximate magnification at all distances and the minimum of lens power at near, these being available in both cylinders and spheres. Most corrections for size and difference were worn in fit-over specs of some sort for expediency. However, these additional corrections can be incorporated in the ametropia correcting lens, though they are sometimes difficult to grind.

While ordinary trial case lenses have magnification, that magnification is to some extent dependent on the clearness of the image, that is, whether or not it is in focus. Flat prisms have distortion, this distortion being a curvature of straight lines toward the base and a squeezing together of the retinal image at that point. However, when ground concavo-convex they lose distortion and acquire magnification such that a 3△ on a —9 base has no distortion and 1.33% magnification. The distance of the prism from the eye also affects its distortion and magnification. As it is also possible to produce distortion without magnification, it follows that all differences in size and shape of the ocular image can be corrected by a combination of size lenses, distortion lenses and power lenses.

IV.

A CLINICAL REPORT OF THE CORRECTION OF DIFFERENCES OF THE SIZE AND SHAPE OF OCULAR IMAGES. Leo F. Madigan and Elmer H. Carlton, M.D.

This paper relates the results of size and shape corrections. One

hundred and thirty cases, most of them referred due to inability to wear ordinary ophthalmic lenses, are analyzed and grouped into three classes: First, those reporting ocular complaints. Second, those reporting extra-ocular complaints and symptoms. Thirdly, those reporting both.

A complete examination of all of these cases was made, the technic varying somewhat from the usual: conformity of images tested and slip phoria taken (this is done without dissociation with the instrument referred to in the first paper); Correction for size and shape was then secured by separate size lenses or by changing the base curve of one of the correcting lenses (ametropia). A temporary correction to be worn overnight was given before final correction was prescribed.

One result of this correction was the either immediate or gradual elimination of suppression, a condition present in 53% of these cases. Many cases required a different size correction at distance and at near necessitating two pairs of glasses. None of these cases were given prism prescriptions for their distorting effect the authors contending that further research is needed before this is done. The paper then contains detailed tabulations of cases arranged by groups according to age, refraction, phoria (horizontal, vertical and cyclo), relation between refractive and muscular conditions, symptoms (general, ocular, and combined), their duration, size differences of normal refractive conditions, and refractive conditions of size normals, length of time size correction was worn, photophobia, suppression and headaches.

The article contains no less than 35 tables covering all conditions involved. The result of this clinical research is that of these so-called complaint cases that were corrected for size and shape difference,

25% obtained complete relief
56% obtained partial relief
19% obtained no relief.

No attempt was made to correct assymetrical differences, the authors remarking on the fertility of the field. Case reports are presented and the article contains a summary and conclusions.

The subject is one the reviewer has felt to be neglected and offering numerous possibilities. He has paid attention to marked differences in size of the ocular image in most refractive cases, even those of relatively low errors. Sparodic attempts at elaboration were made. There is no doubt that alteration in size and shape or distortion is the source of many obscure complaints particularly from skilled workers. Reduction of the correction is a compromise between evils, pursuasion in the hope that the patient will accustom himself is a poor substitute for refractive skill.

The diagnostic method is simple and rapid and is more productive of results than many non-informative and nonsensical myologic tests.

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AMBLYOPIA EX ANOPSIA IN ADULTS

In the Leicestershire Educational Committees annual report, quoted in the November, 1932, issue of the *Dioptric Review*, there is the following comment by the school ophthalmologist:

"Among those children who were given glasses, 24 were found to be suffering from a condition of amblyopia ex anopsia without any accompanying strabismus. . . . It is of the utmost importance to treat these cases as early as possible, to equalise the vision in the child's two eyes, by the prescription of glasses. Once the child has started to suppress the blurred image seen by a weaker eye, however, it is necessary to give that eye as much chance of use as possible. To achieve this in such cases every child is instructed to wear a covering over the good eye during school hours and to do lessons wearing glasses and with this good eye completely shaded from light. These cases are very similar to those of concomitant strabismus in which the same line of treatment is carried out. They are, however, more difficult to diagnose in the early stages, as there is not the external evidence of a squint to draw attention to the defect. The greatest benefit from treatment appears to be gained in young children, and it seems a little doubtful whether there is any advantage in exercising an amblyopic eye in a child over ten years of age."

This latter belief is found in many medical writings and seems to be

believed by many medical refractionists. It is, however, an error. Many cases of amblyopia ex anopsia in patients considerably older than ten have had their vision materially increased by means of optometric orthoptic treatment technics. The writer has had, in his practice, a number of successfully treated cases of amblyopia ex anopsia in patients of more mature years. One case of this character illustrates the folly of advocating these treatments for only our juvenile patients. This case is briefly reviewed here to indicate what splendid results can be accomplished, in case of this type, in a more elderly patient.

Patient, male, age 51. Occupation, construction engineer for a large railroad. This patient has been bridge building for this company for the past twenty-six years and during this time has had his eyes examined at various intervals and on various occasions has been told that something might be accomplished for the sub-normal visual acuity of the left eye. His work, however, necessitated him living away from the large centers of population, most of the time, so that nothing in the way of treatments was ever attempted. He was wearing,

O.D. +1.75 D.Sph.
O.S. +2.75 D.Sph.
Add, O.U. +1.50 D.Sph.

This gave him the following visual acuity. O.D. 20/20. O.S. 5/300. No improvement of visual acuity of the left eye could be secured by any change of lens. An ophthalmoscopic examination of the left eye was negative. The fields were normal and in view of his history and a diagnosis of amblyopia ex anopsia was made.

As the patient had nothing to do at the time and was nearly reporting at railroad headquarters waiting for additional construction work to begin, he decided to have the left eye treated. The usual well known technics were prescribed and at the end of a ten-week period the corrected visual acuity of the left eye was 20/70. Five months later this had improved 20/50+.

This is a report of but one of a number of similar cases of adults successfully treated for amblyopia ex anopsia. While it is true that in most juvenile cases the results are achieved more rapidly, these same results can be obtained in adults, with but a little more perseverance.

C. C. K.

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GLARE

Authorities such as J. Herbert Parsons and Harry Vanderbilt Wurdemann classify the subject of glare in two groups. In the first group, the effects of glare are slight and of brief duration, while in the second group they are more severe, the effects last longer and may even be permanent.

The effects of glare as falling in the first group are the ones which

we as optometrists are frequently called upon to alleviate. In this classification we find a condition developed by moderately intense illumination, the dazzling results of which, while producing discomfort and even pain if continued too long, do not as a rule cause any serious trouble. According to Wurdemann, the pain occasionally experienced by persons subject to glare of the first type is due to excessive action of an inadequate protective mechanism of the eye. Obviously, for these patients whose occupations necessitate them encountering conditions of this character frequently, we can, as optometrists relieve this condition by prescribing absorption glass for use under these trying conditions. It is important, however, to thoroughly investigate the source of the faulty illuminant causing the glare, so as to prescribe a protective correction which will sufficiently absorb a large enough percentage of radiation so as to relieve the condition.

In the second and usually serious group of cases suffering from glare the effects are as a rule due to the intensity of the stimulus, which is often exceedingly rapid in its action, as for instance, when a powerful electric current is short-circuited, or in cases found following the observation of an eclipse of the sun with unprotected eyes. The visual defects caused by intense stimulus of the glare of the second group are of different grades. When the blurred spot, complained of by the patient, is quite transient, it may be considered physiologic, while if the intensity of light is greater or of longer duration, the blurred spot persists and may last permanently. In these latter cases the condition is known as a scotoma. These scotomas are associated later with anatomic changes in the retina, when caused by the greatest degrees of intensity. C. C. K.

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MYOPIA IN NEW-BORN INFANTS

In a study of myopia and its possible hereditary tendencies a number of German investigators made a clinical survey[1] of the refractive condition, with particular reference to myopia, of a large number of new-born infants. This refractive check was done by means of ophthalmoscopy with the following results. Konigstein, Ulrich, Schleich and Herrnheiser found no cases of myopia among 3,200 eyes of newly born children. Herrnheiser only met with one solitary case among 1,920 newly born children examined by him with the direct method of ophthalmoscopy under atropin. He later examined 54.6 per cent of the same children between their first and sixth year and found 4 per cent to be myopic, 24 per cent emmetropic and 72 per cent hyperopic.

These findings indicate that while there still may be an hereditary tendency towards myopia in certain individuals it is at birth at any rate, only a tendency and is certainly not a reality. C. C. K.

[1]J. Hirschberg. The Treatment of Shortsight. Translated by G. Lindsay Johnson. Rebman & Co. New York, N. Y. p. 3, 1912.

RESULTING VISUAL ACUITY AFTER ONE HUNDRED SENILE CATARACT OPERATIONS

Knorr gives a report[1] of one hundred senile cataract operations that were performed at the Presbyterian Eye, Ear, and Throat Hospital, Baltimore, Maryland, between August 18, 1925, and January 31, 1928. The operations were consecutive. There was no selection other than that of determining whether they were suitable for operation. All patients were accepted for operation who had good light projection, an active pupillary light reflex, and freedom from all external and internal eye inflammations. Of this group 57 were males and 43 were females. Their ages ranged from 42 years of age to 84 years of age, the average age being around 70.

The corrected visual acuity of this group after the operation is as follows:

Number of Patients	Visual Acuity
2	20/15
25	20/20
6	20/30
22	20/40
5	20/60
9	20/70
1	20/80
12	20/100
8	20/200
3	20/300 or less
3	blind
4	not recorded
Total 100 cases	Average Visual Acuity 20/55

Knorr's figures indicate a high probability of success in the surgical restoration of vision in these cases of senile cataract. While the figures he gives show an unusually high percentage of corrected cases with an acuity of vision of 20/40 or better, (some 55%) they do, in the writer's belief give us as optometrists an idea of the general success of this surgical remedy for cataract, which we can pass on to those of our patients who are suffering from this malady. C. C. K.

BOOK NOTICES

MODERN PHYSICAL THERAPY TECHNIQUE, by Dr. Chas. L. Ireland. Published by the Author, 47 West Third Avenue, Columbus, Ohio. 412 pages, 225 illustrations, 1932, Price $7.00.

The book, "Modern Physical Therapy Technique," comes from a man with years of experience in this special field. Dr. Ireland tried to get away from the theoretrical part of this subject and instead organized this

book as a manual so that the busy physician can easily turn to any subject and quickly find the proper technique described and how it is to be applied. Most of these techniques are profusely illustrated. This places this book in a class by itself. There are also included charts showing the reflex centers for applying sinusiodal currents to the body and also motor points for making electro diagnosis. There are also found a few techniques described for the ocular application of some physical agents.

J. I. K.

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ENQUIRY INTO THE MANUFACTURE OF GOLD-FILLED SPECTACLES. Report of a Special Commission of the Joint Council of Qualified Opticians. Cliffords Inn Hall, Fleet St., London, E. C. 4., 60 pp., 26 illustrations. Loose leaf. Paper covers. 1932.

This is the report of an investigation made by members of the J. C. Q. O. because of repeated complaints of English insurance societies as to the widely varying prices of gold-filled frames for spectacles of apparently similar specifications. The report goes into some detail as to the process by which gold-filled material is made, and also gives considerable space to the technical problems encountered in making frames. It is also interesting to note that the Commission found in making its investigation that various frames, all bearing the same stamp contained widely different amounts of gold, some coming almost up to standard while others not even reaching the half way mark of the quality to which they were to come.

In England, the standard of quality for this sort of material was 1/10th 10-ct. This was found to be too low and the Commission, after its investigation recommends changing this to 1/10th 12-ct, with a more rigid inspection to keep the materials to that standard. This report itself is quite complete, the photomicrographic illustrations being particularly good.

C. C. K.

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MEDICAL JURISPRUDENCE. Carl Scheffel, Ph.B., M.D., LL.B. Published by the P. Blakiston's Son & Co., 1012 Walnut St., Philadelphia, Pa. Cloth. $2.50. 1932.

Here is an exceedingly well written book on the law as it affects the physician, and for that matter any professional man practicing a healing art. Scheffel uses the plan of illustrating points with actual cases bringing out his facts in a very clear understandable way.

C. C. K.

ANNOTATIONS
AND
SOCIETY PROCEEDINGS

The American Journal of Optometry is the Official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

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FEINBLOOM'S CONTRIBUTION TO OPTOMETRY

For the past eight years Dr. William Feinbloom, optometrist of New York City, has been working on the problem of improving vision in those individuals whose visual acuity is decidedly sub-normal as measured and corrected by ordinary methods. His investigation led him to a study of the telescopic spectacle as had been used by refractionists for the past decade and incidently he devised several improvements in the matter of prescribing these lenses. A careful study of the results of using these telescopic spectacles soon made him keenly aware of their limitations and after several years of experimental work he announced at the annual meeting of the American Academy of optometry in Chicago last December, his new *Sub-normal Vision Lens.*

This new lens is based upon certain principals used in telescopic spectacles, yet these have been changed materially. The method of arriving at a suitable correction is markedly different from the usual procedure of prescribing a telescopic spectacle; the formula prescribed is entirely changed and these new sub-normal vision lenses can be used for distance, a thing impossible with the ordinary telescopic spectacle.

Feinbloom has therefore contributed something of lasting and real value to mankind and as optometrists we are fortunate in finding him among those in the fore of the scientific development of our profession.

The Academy recognized this in awarding him $1,000 to partially assist him in his numerous research problems. He has, however, decided to use this money in giving his new sub-normal visual equipment to a number of needy individuals who will thus be given a renewed interest in life by thus being made to see again.

His presentation of this new subject before the Academy was typical of the man. It was presented to this group in an orderly manner, he advancing his facts in a clear understandable way. There was a complete absence of the theatrical, yet when the press discovered what had happened at this closed meeting he was besieged by various staff writers and over night the story became the property of the American Press. In fact, papers throughout the world carried the announcement of this splendid new contribution to optometric technics and the mails were filled with congratulatory letters and requests for detailed information.

So numerous were these requests and because of the importance of the subject, Dr. O. J. Melvin, chairman of the Academy, authorized the editor of the American Journal of Optometry to prepare a special printing of Feinbloom's work on the Telescopic Spectacle and the New Sub-Normal Vision Lens for distribution to refractionists. This will be published immediately following the Acadamy Year Book and will contain all of the available material from the pen of Dr. Feinbloom on these two co-related subjects. Readers interested in securing a copy of this book are referred to page VIII of the advertising section of this Journal.

C. C. K.

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NOTIFYING PATIENTS FOR RE-EXAMINATIONS

It has become rather common practice in optometric circles to notify patients at the end of a certain period, (usually two years) that so much time has elapsed and it is, in the optometrist's judgment, now time for the patient to again consider having his or her eyes re-examined.

Despite the optometrist's obvious selfish interest in the matter the idea is, from the standpoint of the patient, a fair one, *providing it is done in the proper professional spirit*. This is important and it is at this point that many optometric practitioners fall down.

The writer has talked with men who have sent patients letter after letter in a seemingly endless chain. Letters four or five paragraphs in length, some pleading and some demanding and some even threatening possible blindness unless the luckless patient rushes in for an immediate re-examination. Such nonsense!—and imagine, if you please, the patient's reaction to such rank commercialism of a professional science. Just what must a patient think of a professional man who is so eager to do more work for one that he must resort to mailing out a waste-basket full of mail each six months in the effort to drag back a reluctant patient.

Needless to say, the more of this that goes on the less one's patients are apt to think of the optometrist who uses such tactics.

Now just what can and should be done regarding this matter, keeping *good taste* and *professional ethics* in mind? Well, the answer to this is very simple.

In the first place, no notice of any kind should ever be sent to a patient without his or her permission. At the close of a refraction the optometrist can easily turn the conversation to a discussion of a second refraction at some later time and then can politely ask the patient whether or not he or she would like him to notify either him or her at the time agreed upon. As this time is many months in the then distant future nearly all patients will readily agree that the idea is a fine one and will thank you for your thoughtfulness. You now have permission to do but one thing and that is, on the agreed-upon appointed time drop the patient a note merely calling the patient's attention to the pre-arranged re-examination period. It needs no long-winded letter, nor any sales psychology nor any high-pressure. The famous line created, I believe, by Ryer and Hotaling is sufficient. It reads as follows:

"The time has arrived, when to insure their best care, your eyes should again be examined."

That is all. It tells the entire story. It tells it at a glance and if your work has been properly done at the time of the first examination, the above line will prove effective.

Remember, from the standpoint of good taste and professional ethics one must first get the patient's permission and later on use but a single short note of reminder. **Nothing else should be sent, as professional** good taste is violated by an **endless series of bombastic letters.**

C. C. K.

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AM. JOUR. OF PHYSIOLOGICAL OPTICS

Dr. Harry Lee Fording, president of the North Pacific College of Optometry, has the following extra issues of the *American Journal of Physiological Optics*, a quarterly which formerly was published by Professor Charles Sheard: January, April, July and October, 1920; April, July and October, 1922; April, July and October, 1924; January and July, 1925; January, April, July and October, 1926. Persons interested in securing any of these journals should communicate directly with Dr. Harry Lee Fording, 1192 Sandy Boulevard, Portland, Ore.

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EUROPEAN TOUR WITH LECTURES

Dr. G. O. Ohlsson, optometrist, 402 Fine Arts Building, Detroit, Michigan, announces the formation of a combined cultural and vacation party, sailing for Europe from New York on the Steamship Washington of the United States Line on June

7th. This group will have optometric lectures and conferences on the steamer both east bound and west bound and will visit the University of Jena, the Jena School of Optics and the Carl Zeiss Works. The party and tour is limited to optometrists, members of their families and optometry students. Total all inclusive expense, to New York and return $269.50. The incentive to compare notes and experiences will be such as to make for a better understanding between optometrists, the registration being limited to those practitioners in good standing in their local, state and national associations.

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BETTER VISION INSTITUTE

An educational campaign which should prove of unusual value has been inaugurated by the Better Vision Institute. The aim of this campaign is to bring to the attention of the school teachers, principals and pupils the importance of normal eyes and how eyesight can be conserved. The campaign material consists of eight full colored wall charts and material for teachers and home use. There is also a small folder which is a complete reproduction of the large wall charts. The teachers manual, "The Eye and How We See," is a twenty page booklet and contains many valuable lessons about the eye in work sheet form. The last two pages contain a number of questions and answers pertaining to the use and abuse of the eyes.

The Institute Secretary stresses the importance of using this educational material in offices and refracting rooms only, and that it should not be used for display or other commercial uses. The officers of the Institute are to be congratulated upon taking this stand. Many good ideas and projects in the past have failed because they were exploited commercially and cheapened by using them in display windows.

The Better Vision Institute is doing a fine piece of educational work and as long as the work is carried out on this high ethical level it deserves the support of all ethical optometrists.

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BACK COPIES WANTED

Dr. Turner O. Veith, 4139 Sixty-eighth Street, Woodside, L. I., N. Y., wishes to secure three copies of February, 1932, issue of the American Journal of Optometry. Any one having one or all of these copies to spare should communicate direct with Dr. Veith at the above address.